

tributes data for the problem of evolution in man, anthropometric data from Australia; Miss Beeton and Prof. Pearson furnish a paper on the inheritance of the duration of life and the intensity of natural selection in man; Mr. E. T. Browne writes on variation in *Aurelia aurita*, and Prof. Weldon on a first study of natural selection in *Clausilia laminata*.

This first list of contributions augurs well for the future of an undertaking which deserves support from all workers in science who are interested in the theory of organic evolution in its broadest applications. The points of contact between mathematicians and biologists have hitherto been but few, and the time is yet remote when we may look for the advent of a skilled mathematician who shall also be an expert biologist, or *vice versa*. But although the modern biologist may be unable to follow the mathematical processes of the new method, he will assuredly be impressed with the importance of the results, and such a work as that which has now been launched will serve as a common meeting ground for both classes of workers. The recognised methods of studying living organisms from the points of view of systemy and taxonomy, embryology, histology and anatomy, bionomics and distribution have all contributed to the sum total of that great division of natural knowledge which is known by the comprehensive title of biology. Side by side with these we must now place the newer statistical methods inaugurated with such marked success by Galton. This latest claimant to recognition as a legitimate weapon of scientific attack may be looked at with suspicion by those who are accustomed only to the older methods. We may remind our readers, however, that the value of measurement and statistical treatment was fully realised by Darwin, as made clear in one of the editorial articles in the present part of *Biometrika*. We may point out also that Wallace in his "Darwinism" (1889) fully recognised the value of such methods, and made considerable use of the measurements of lizards by Milne-Edwards and of birds by Mr. J. A. Allen for his discussion of the question of individual variability as furnishing the material for the operation of natural selection. Such data were imperfect compared with the modern requirements of statistical methods, but so far as they went they have been of service to the cause of Darwinian evolution, and this fact, again, tells strongly in justification of the appearance of a new periodical devoted entirely to this phase of biology.

There is no real antagonism—as some men of science have supposed to exist—between the older methods and the latest statistical methods. They are, or should be, on the contrary, mutually helpful. If by the measurement of large numbers of individuals and the mathematical treatment of such data the trend of evolution in any species can be detected, here at once is a suggestion for the observing naturalist to work upon—to endeavour to find out the nature and cause of the survival in a certain direction; in other words, to hunt down the selecting agent. Where ordinary observation has in so many cases failed, the newer methods appear to open out endless possibilities of attacking such problems. The student of bionomics will, as statistical data and their deductions accumulate, have definite information given as to what is going on in particular species, and it will be for him to approach the study of such species armed with specific questions awaiting answer in the field or laboratory. We venture to think that, far from any antagonism existing between the older and newer methods, the introduction of statistics in the Galtonian sense cannot but give a great impetus to observational work. It may be added that the periodical is really cosmopolitan, and the editors invite contributions in German, French or Italian, as well as in English. We cordially wish the new journal the success which it merits

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ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held as usual on St. Andrew's Day, November 30, when the annual report of the Council to the Fellows was presented. Among the subjects mentioned in this report is the proposal to establish a British Academy, which was discussed at a special meeting of the Society held in May last.

Reference is made by the Council to the subject of the tenure of office of the secretaries, which was recently raised again. A memorial "praying the President and Council to take into immediate consideration the advisability of limiting the tenure of office of any future treasurer or secretary," and also a memorial expressing the decided convictions of the memorialists that the change advocated by the preceding memorial would not be in the interests of the Society, were taken into consideration at the meeting of the Council on November 7. It was proposed, as a resolution, "That in the opinion of this Council it is desirable that the secretaries should not be so re-elected as to hold office for a period exceeding ten consecutive years, this resolution not to apply to the present holders of office," and, after considerable discussion and the consideration of various amendments, the resolution was carried.

As already announced, in consequence of his appointment as Principal of the University of London, Prof. Rücker has resigned his office as secretary, and is now succeeded by the distinguished mathematician and physicist, Dr. Joseph Larmor.

The address of the president referred to the scientific work of the Fellows and Foreign Members deceased since the former annual meeting, and a few investigations commenced or carried on in the course of the year. The work of this year's medallists was described as follows:—

COPLEY MEDAL.

Prof. J. Willard Gibbs, Foreign Member, R.S.

The Copley Medal is awarded to Prof. J. Willard Gibbs, a Foreign Member of this Society, for his contributions to mathematical physics.

Although Horstmann had demonstrated, between 1869 and 1873, the applicability of the mechanical theory of heat to the elucidation of the phenomena attending dissociation, J. Willard Gibbs was the first to apply the second law of thermodynamics to the exhaustive discussion of the relations between chemical, electrical and thermal energy and capacity for external work. His great contribution to this subject appeared in the *Transactions* of the Connecticut Academy in two parts, the first in 1875 and the second in 1878. In this paper, which opens with a discussion of the criteria of equilibrium and of stability as applying to a material system, the conditions of equilibrium prevailing in both homogeneous and heterogeneous systems of gaseous, liquid and solid materials are considered in a highly generalised form; and it is shown by Gibbs that Deville and Troost's experimental values of the density of nitrogen peroxide at different temperatures, and Playfair and Wanklyn's results obtained with mixtures of nitrogen peroxide and nitrogen, can be interpreted quantitatively with the aid of his fundamental gas equation.

The most important result of Gibbs's work, from a chemical standpoint, is the so-called "phase rule," the law which governs the general case of complete heterogeneous equilibrium. This law, which was developed theoretically, states that a system in complete heterogeneous equilibrium must be composed of at least n different molecular components if it consists of $n+1$ different phases.

The application of the phase rule has been repeatedly verified experimentally under a great variety of aspects. During the last few years the recognition of the law has led, amongst other important results, to a complete systematisation of our knowledge concerning dissolution of solid substances, the distribution of a solute between two immiscible solvents, and to the formation of double salts and of racemic, pseudo-racemic, non-racemic

and externally compensated substances. The phase rule has also been applied with complete success by van 't Hoff to the elucidation of the formation of oceanic salt deposits. In fact, Willard Gibbs's generalisation is applicable to all cases of reversible chemical interchange, and consequently to chemical change generally.

ROYAL MEDAL.

Prof. William Edward Ayrton, F.R.S.

A Royal Medal is given to Prof. William Edward Ayrton, F.R.S., for his contributions to electrical science.

The services rendered by Prof. Ayrton to science during the last twenty-seven years may be roughly grouped under two heads. He has carried out a large number of researches in pure physics, and he has taken a very prominent part in the development of the application of electricity to industry, which has been so remarkable a feature of the closing years of the nineteenth century. It is not here necessary to refer particularly to his researches, invention and inspiration under the second head. At all times he has been doing service under both heads. From 1873 to 1878, in Japan; from 1879 to 1884, at Finsbury; and from 1884 to the present time, at the Central College, Kensington, he has acted as professor of physics; he has arranged large laboratories, and through his own example in research he has inspired many students, who are now carrying out investigations of their own.

A large number of papers contributed, sometimes alone and sometimes in partnership with others, to the Royal Society *Proceedings* and *Transactions* and other scientific publications, while belonging to the second group above mentioned, have greatly assisted in pure physics.

It is not out of place to quote a published remark of the late Prof. Clerk Maxwell in reference to the work of Prof. Ayrton and a colleague in Japan, that they had moved the centre of gravity of electrical science greatly eastward.

ROYAL MEDAL.

Dr. William Thomas Blanford, F.R.S.

The other Royal Medal is conferred upon Dr. William Thomas Blanford, F.R.S., for his work in connection with the "Geographical Distribution of Animals."

Dr. W. T. Blanford received his scientific education at the Royal School of Mines, and, after special instruction in the methods of geological surveying under Prof. (afterwards Sir Andrew) Ramsay on the English Geological Survey, proceeded in 1855 to take up a post on the Geological Survey of India.

Between the years 1855 and 1868, when he was engaged in surveying different parts of India and Burma, he published a number of valuable papers on Indian geology, and upon malacology and other branches of natural history, based on observations made during his travels as a geological surveyor.

In 1868 he was appointed to accompany the expeditionary force under Lord Napier to Abyssinia in the capacity of naturalist, and his observations on the geology and fauna of the country are published in a number of communications to scientific journals and in his work, "Observations on the Geology and Zoology of Abyssinia," published in 1870.

Between 1868 and 1872, Dr. Blanford returned to his work on the Geological Survey of India, and as the result of his labours in Sind, Cutch, the Deccan and other parts of the country, a number of memoirs dealing with geology, malacology and ornithology were published by him. In 1872 he was selected to act as naturalist to the Persian Boundary Commission and the results of his observations appeared in a work, "Eastern Persia, vol. ii., Zoology and Geology," which was published in 1876.

Returning to India, he not only carried on the usual survey work, but, in conjunction with Mr. H. B. Medlicott, prepared the important "Manual of the Geology of India," 3 vols., 1879. In this work a most valuable summary of the geological observations which had been made upon all parts of the Indian Empire is given, with a discussion of the age and relationships of the formations of that vast district.

Since his return from India, in 1882, Dr. Blanford has been continuously engaged in zoological and geological researches. His memoirs on the rocks of India and Australia which exhibit glacial conditions, and on kindred subjects, have been most valuable contributions to geological science. Equally important have been the two addresses on "Geological Nomenclature" and "The Permanence or otherwise of Ocean

Basins," which he delivered in his capacity of president of the Geological Society in 1889 and 1890. In the last-mentioned address he has laid down principles and established conclusions which have given a new aspect to the study of the geographical distribution of animals.

"The Fauna of India," published under the authority of the Secretary of State for India in Council (8 vols., concluded in 1898), was edited by Dr. Blanford, who has contributed three volumes on birds and mammals. This work has been most favourably received by the scientific public and is looked upon as the standard authority of Indian vertebrates. His contributions to this work constitute his special claim to a Royal Medal.

Dr. Blanford is one of the few men who are regarded as an authority on geology, palæontology and zoology, to each of which branches of science he has largely contributed.

DAVY MEDAL.

Prof. George Downing Liveing, F.R.S.

The Davy Medal is awarded to Prof. George Downing Liveing, F.R.S., for his contributions to spectroscopy.

Prof. Liveing's papers on spectroscopic subjects have been mainly published during the last quarter of a century in conjunction with Prof. Dewar, and have appeared for the most part in the *Proceedings* of the Royal Society. They make up a record of patient, accurate, conscientious labour, and, taken together, constitute one of the most valuable contributions to this department of chemical physics yet made by British workers.

SYLVESTER MEDAL.

Prof. Henri Poincaré, Foreign Member, R.S.

The Sylvester Medal, given this year for the first time, is awarded to Prof. Henri Poincaré, a Foreign Member of this Society, for his many and important contributions to mathematical science.

Prof. Henri Poincaré's mathematical writings display very great originality, independence of thought and far-sightedness. The number of the memoirs and works which he has published is extraordinary, and the wide range of subjects in pure mathematics and its applications to astronomy and physics which they cover is equally remarkable. The bond of unity which connects his investigations is that nearly all have a more or less intimate connection with the study of differential equations. He has dealt with the theories of linear differential equations, of ordinary non-linear differential equations and of partial differential equations, with striking results in each theory; and each is associated with a department of his other important researches.

In the theory of linear differential equations, Fuchs had called attention to the substitutions by which different particular integrals are interchanged at the critical points. The substitutions form a group, and (at any rate when the equation is of the second order) there exist automorphic functions which are unchanged by the operations of the group. M. Poincaré has constructed these functions and shown how by means of them a complete integration of the linear differential equation can be effected (*Acta Mathematica*, t. iv.). He has devoted five classical memoirs (*Acta Mathematica*, i., iii., iv., v.) to a profound study of the automorphic functions and Fuchsian and Kleinian groups. Closely related to the same study are his delicate researches as to the topology of loci in space of n dimensions, and a number of contributions to the theory of algebraic functions.

In the theory of ordinary differential equations (not linear) he has introduced a new method of dealing with the question of the existence of a solution, and has shown how various methods of approximating to a solution may be utilised for solving the problem which gives rise to the differential equation. This lies at the root of his investigations in connection with the equations of dynamics and the special problem of gravitational astronomy—that of n bodies. He has shown that G. W. Hill's periodic solution of the problem of three bodies is one of an infinite system. M. Poincaré has also discussed from the point of view of modern analysis the methods of solution in periodic series which are associated with the name of Laplace and with the problem of the stability of the solar system, and has been led to give the first complete theory of series of the kind now called "asymptotic," and to point out their uses in analysis.

Mathematical physics requires the investigation of certain

partial differential equations, and the problem arises to develop a formula from which the solution, subject to boundary conditions, can be calculated. The problem can in any case be reduced to the discovery of what is now called a Green's function. To Poincaré is due perhaps the most feasible means yet devised for arriving at these functions. A general analytical theory has also been given by him of a somewhat different problem, required in theories of vibration and electrical oscillation. The diffraction of light has also been discussed by him in an elaborate memoir.

He has besides enriched pure mathematics with researches in the theory of numbers and on double integrals. In applied mathematics he has obtained remarkable results with regard to the figures which can be assumed by rotating fluid. To dynamical astronomy he has contributed, not only memoirs, but a monumental work in three volumes—"Les Méthodes Nouvelles de la Mécanique Céleste."

Finally, allusion may be made to the services which M. Poincaré has rendered to a number of branches of mathematical physics, by critical presentation of the work of others in published courses of lectures.

The officers and Council elected for the ensuing year were the Fellows whose names have already been given (p. 34), with two others to supersede two Fellows who found themselves unable to serve (p. 85).

On the evening of Saturday, the Fellows and their friends dined together in the Whitehall Rooms, when, to quote the *Times* report, "no Cabinet Minister and only one ex-Minister—Mr. John Morley—was present. Thus the calm discourse of the men of research was undisturbed by even the suggestion of political strife." It might also have been added that thus do Ministers of State manifest their indifference to associations having no political significance.

NOTES.

WE regret to announce the death of Sir William MacCormac, the distinguished president of the Royal College of Surgeons.

PROF. YVES DELAGE has been elected a member of the section of anatomy and zoology of the Paris Academy of Sciences in succession to the late Prof. Lacaze-Duthiers. Prof. Gouy, professor of physics in the University of Lyons, has been elected a correspondant of the Academy in succession to the late Prof. Raoult.

In response to appeals made by the Dover Chamber of Commerce to the Trinity House to place wireless telegraphy installations on the lightships in this part of the English Channel, an intimation has been received by the Chamber that the matter is under consideration by a special inter-departmental committee.

THE National Antarctic Exploration ship *Discovery* arrived at Lyttelton on Nov. 23. The ship has been dry-docked for caulking, having sprung a leak, though not a serious one.

MR. JONATHAN HUTCHINSON, F.R.S., is about to proceed to South Africa with the view to study the cause of leprosy. He will proceed to Robben Island, and will probably go on to Natal and Basutoland. His object is especially to obtain facts as to the use of dried and badly salted fish. Leprosy is a comparatively new disease in Cape Colony, and quite so in Natal and Basutoland. Thus these districts offer exceptional opportunities for ascertaining its cause.

THE Berlin correspondent of the *Times* reports that the German Imperial Estimates include the sum of 150,000 marks (7500*l.*) to be devoted to the prevention of tuberculosis and to the investigation of that disease. The sum will be largely applied to the promotion of research with the object of settling the question of the identity of tuberculosis in human beings and in animals. For the promotion of markets for agricultural produce and for the support of scientific, technical and kindred undertakings in the interest of agriculture a sum of 90,000 marks will be demanded, as against 50,000 marks last year.

EX-GOVERNOR EYRE, who died on Saturday at the age of eighty-six, was less known perhaps for his geographical work than for his action in connection with the disturbances in Jamaica thirty-six years ago. Yet he was an intrepid explorer, and in 1843 he received the Founder's Medal of the Royal Geographical Society for his explorations in Australia. He crossed the Australian continent overland from Sydney in the east to Swan River in the west, and investigated the then unknown shore of the Great Australian Bight between King George's Sound in Western Australia and Port Lincoln in South Australia. In 1845 he published the results of his explorations in a work entitled "Discoveries in Central Australia."

A SPECIAL expedition, under Dr. Charles Balfour Stewart, has just been sent by the Liverpool School of Tropical Medicine to the Gold Coast and to the gold-mining districts of that colony, to conduct a series of operations there with a view to improve the conditions of health and sanitation. Dr. Stewart was to have sailed for Cape Coast Castle on November 16, but his departure had to be delayed as the municipal authorities of Liverpool requisitioned his services to deal with an outbreak of plague in the city. The lines on which Dr. Balfour Stewart will proceed will be similar, so far as possible, to those now being followed by the Sierra Leone expedition of the Liverpool School under Dr. Logan Taylor.

THE death is announced of Mr. Samuel Rowles Pattison, who for some years was a member of Council of the Geological Society and its honorary legal adviser. In early life he resided at Launceston, where he made a collection of fossils from the limestone of Petherwin, and assisted by his local knowledge both De la Beche and John Phillips. He contributed papers on local geology to the *Transactions* of the Royal Geological Society of Cornwall and the Royal Institution of Cornwall from 1840 to 1860; and in the *Quarterly Journal* of the Geological Society of London he recorded the occurrence of auriferous quartz-rock in north Cornwall. In 1858 he published a work entitled "The Earth and the Word; or Geology for Bible Students." Mr. Pattison, who had attained the ripe age of ninety-two, died on November 27.

THE results of an analysis of the returns relating to the outbreak of small-pox in London are given in an article in Saturday's *Times*. There have been 349 completed cases, that is, cases which have ended in death or recovery, since May last. Of these 349 patients 181 were males and 168 females. The number of deaths was 116, and the rate of mortality was three times as great among the unvaccinated as among the vaccinated. The following points brought out by the classification of the cases are instructive:—(1) All the cases under five were unvaccinated, and out of 23 there were 19 deaths; (2) all the children under ten were unvaccinated except one, and out of 42 there were 29 deaths, all the deaths being of unvaccinated children; (3) out of a total of 81 children under fifteen years 57 were unvaccinated and 38 died. Only one death out of the 38 took place in a vaccinated child; of 24 vaccinated children 23 recovered. These facts show the fatality of the disease among young children and the protection afforded by primary vaccination against attack in the first instance and against a fatal result in the second. The protection diminishes progressively after childhood, but the rate of mortality remains enormously higher among the unvaccinated in every age period.

THE results of several series of experimental work in connection with the cultivation of hops were described at the conference of hop-growers held at the South-Eastern Agricultural College last week. The object of the meeting was to receive and discuss the reports of the various experiments upon hops that have been carried out by the College during the past